Advanced Doppler Radar

1b. Describe the WSR-88d system concepts and the function of its different components.

System Configuration

- **The WSR-88D is a tri-agency system that was developed to support three separate agencies or principle users**
- **These agencies include the following:**
  - Department of Commerce (NWS)
  - Department of Defense (DOD)
  - Department of Transportation (FAA and Coast Guard)

Network Configuration

- **The WSR-88D is designed to cover the entire US with an umbrella of radar coverage**
- **This is accomplished by a vast network, which will support each agency member and their mission requirements**
- **Each agency shall endeavor to support, to the maximum extent possible, the data, products, and operational requirements of the other agencies within the network**

Network Configuration

- **WSR-88D sites are categorized as network, supplemental, or non-network**
  - **Network Site**
    - A network site is a Department of Commerce (NWS) WSR-88D site that continuously collects, collates, and makes available radar products in support of the National Weather Radar Network
    - The National Weather Radar Network consists of 120 sites dispersed throughout the contiguous United States (CONUS) It provides nearly complete coverage of precipitation and severe weather events that would affect the CONUS and the National Airspace System

Network Configuration

- **Supplemental Site**
  - A supplemental site is a Department of Defense WSR-88D site in the CONUS or a Department of Transportation (FAA) non-CONUS site
  - These sites provide data via a dedicated or dial-in telephone link to a nearby National Weather Service Warning and Forecast Office
  - A Department of Defense site in the CONUS continuously collects, collates, and makes available radar data and products in support of the Department of Defense and the National Command Authority

Network Configuration

- **Non-network site is a WSR-88D site that has neither network nor supplemental site reporting responsibilities**

Network Configuration

- **Two types of users**
  - **Principle users**
    - **National Weather Service**
    - **Air Force Weather Agency**
    - **Naval Meteorology & Oceanography Command**
    - **Federal Aviation Administration**

Network Configuration

- Principle users are considered either associated, or non-associated
  - An Associated User is a principle user with dedicated communications within a WSR-88D unit
  - A non-associated user is a principle user who has only dial-in communications to a WSR-88D unit

Network Configuration

- **Other users**
  - Other users are anyone other than a principle user who has access to WSR-88D products
  - These include information service companies, broadcast meteorologists, airlines, and other aviation interests, universities, etc

Network Configuration

- **Unit Radar Committee (URC)**
  - **Committee is comprised of one voting member from the DOD, DOT, and DOC in the CONUS**
    - Overseas the committee is comprised of one voting member from each associated user
    - The committee is responsible for establishing alert thresholds, paired alert products, algorithm thresholds, and many other things

Major Components

- **Radar Data Acquisition (RDA)**
  - **The RDA includes the antenna and all other necessary hardware to control the antenna and preprocess meteorological data**
    - It provides for the detection and measurement of meteorological and hydrological phenomena
    - This includes anything from raindrops, to dust, to insects, to refractive gradients
    - Optimal use of the radar depends on the RDA detecting scatterers in the atmosphere that can give us information to help with forecasts, observations, and/or warnings

Major Components

- The RDA performs signal processing of Doppler weather radar data and transfers this data in the form of reflectivity, velocity, and spectrum width base data to the Radar Product Generator
- The RDA provides the capability to monitor and control the WSR-88D antenna, and also provides a maintenance control terminal in support of both operations and maintenance activities

Major Components

- There are four basic subcomponents, which make up the RDA They are the antenna assembly, transmitter, receiver, and signal processor (data preprocessing) computer equipment
  - Antenna Assembly
    - » Antenna

      a. The WSR-88D antenna is a parabolic dish 28 feet in diameter (the FPS-77's is 8 feet), which produces a beam width of approximately 1˚

      b. In the WSR-88D's operational mode, the antenna rotates continuously in azimuth at a maximum speed of 5-rpm (revolutions per minute) and moves in predetermined incremental steps in elevation from 05 to 195˚

      c. The elevation steps are determined by the particular volume coverage pattern (VCP) being used

Major Components

» Transmitter

a. The transmitter is a high-power, 10-cm wavelength, pulse amplifier that generates the high-power radio frequency (R-F) pulse for transmission by the antenna

b. To accomplish this, the WSR-88D uses a klystron tube instead of the magnetron tube, which was used in older radar

c. The klystron provides for a very stable output of energy that is critical to the Doppler detection process

Major Components

d. The transmitter has an operating frequency range of 2,700 to 3,000 MHz

e. Its operating power is 750 kilowatts with a peak output power of 1-megawatt (1,000 kilowatts) This is almost 3 times more powerful than the FPS-77!

Major Components

» Receiver is a highly sensitive device, which amplifies the R-F energy returned to the antenna and transfers this analog data to the signal processor

» Signal processor

a. The signal processor's main job is to take the raw analog data from the receiver and process it into digital base data

b. It also determines which predefined volume coverage pattern the antenna assembly executes

c. Other functions include ground clutter filtering, range unfolding, data thresholding, archive storage (level II), and allowing RDA control to maintenance personnel

Major Components

- **Radar Product Generator (RPG)**
  - **The RPG is considered the "brains" of the WSR-88D unit**
    - It includes high-speed computers, extensive memory capacity, and provides computer control to the RDA
    - The RPG accepts the Doppler weather data from the RDA and produces a set of meteorological products
    - Product generation is accomplished by the execution of meteorological algorithms that are stored in the RPG computer

Major Components

- Algorithms are the individual computer programs, which enable the RPG to produce usable products from the base data received from the RDA
- Additionally, the RPG provides for product storage and distribution, alert processing, RDA control, and status monitoring
  - Central Processing Unit (CPU)
    - » The CPU consists of a Concurrent Corporation 3285 processor which receives base data from the RDA, processes the data into meteorological and hydrological products through the execution of algorithms, then stores and distributes these products
    - » Velocity dealiasing and certain system algorithms such as auto PRF, alert processing and loadshedding/product priority is carried out within the CPU as well

Major Components

» The CPU supports the loading of operating software from an external disk into the RPG's shared memory

a. Shared memory

(1) The processing equipment provides shared memory of 8 megabytes

(2) Shared memory enables the RPG to perform many processing tasks simultaneously

(3) These tasks include velocity dealiasing, product generation, loadshedding, alert processing, one-time product requests, and other functions critical to operational demands

Major Components

a. Mass storage

(1) The mass storage device is a fixed media, 600-megabyte magnetic disk

(2) This disk has self-diagnostics and automatic error checking and correction capabilities

(3) The mass storage provides a place to read and write both programming and product information

Major Components

b. Archive storage (LVL III)

(1) The RPG processing cabinet includes an optical laser disc drive

(2) Optical discs are capable of permanently storing up to 654 megabytes or 168 hours of product data

(3) The optical disc is a "WORM" (write once, read many) which means that once data is copied on the media, it cannot be erased or overwritten

Major Components

c. SCSI (Small Computer System Interface) Tape Drive

(1) The RPG processing cabinet also includes a SCSI magnetic 1/4" tape drive

(2) A SCSI tape is capable of permanently storing up to 60 megabytes of product data

(3) Unlike the optical disk, it can also save system and application files such as adaptation data, user functions, command substitution systems, etc

Major Components

- **Unit Control Position**
  - **Control of the RPG is accomplished from a computer terminal known as the Unit Control Position (UCP)**
  - **Access and control of the RPG effectively means control of the entire system**
  - **The UCP provides an appropriate operator interface from which control and monitoring functions are carried out**

Major Components

- **All Air Force UCPs will be remotely located, which means data communications with the RPG is via a dedicated narrowband communications link**
- **At the majority of CONUS locations, the UCP is owned by a National Weather Service forecast office**
- **This means that a good working relationship with the NWS is very important**
- **Unit Radar Committees are established for each system site and written guidance is available to help make this inter-agency coordination a little easier**

Major Components

- **The UCP is given authority by the URC to make on-the-spot changes to support associated users**
- **All decisions made by the URC are carried out by the UCP**

Major Components

- **UCP consists of three control interfaces to the RDA and RPG: Applications function, system control function, and the maintenance terminal**
  - Applications Function
    - The UCP applications function provides the user with the capability to control and monitor RPG/RDA operations and communications
    - Functions include controlling product generation and distribution and performing archival functions
    - It also provides for the monitoring of the RPG and RDA thus allowing the operator to check the status at any time

Major Components

- System Control Function
  - The RPG system control (system console) function provides a user interface to the RPG processor via the operating system (OS/32) and the Control Diagnostics System (CDS)
  - Specific operations that may be performed at the RPG system console include disk and tape maintenance operations, start and stop of the application software, and running system diagnostics

Major Components

- Maintenance Terminal
  - The maintenance terminal is a computer terminal collocated with the RPG if the UCP is remotely located
  - It is capable of communicating with both the RPG and the RDA and is used solely by maintenance personnel

Major Components

- **Principal User Processor (PUP)**
  - **The Principal User Processor (PUP) is the workstation**
  - **At the PUP, radar operators request and control WSR-88D products, manipulate the products to suit your needs, make hard copies, monitor the status of the WSR-88D system, and a number of other user interface functions**

Major Components

- **The PUP provides you, the WSR-88D user, with the capability to request products from the RPG; display, edit, annotate, distribute and locally store products; monitor the status of the RDA and RPG; and perform archival functions**
- **The PUP consists of a workstation, processor, system console, copier, and the archive device**

Major Components

- The PUP workstation
  - Consists of two 19-inch color graphic displays, applications terminal and system console (which are alphanumeric terminals), a graphic tablet and puck (similar to a mouse), and a hard copy device (printer)
  - The workstation is the interface to the display and graphic processors
  - The workstation has the capability to display products on the graphic color monitors and the alphanumeric terminal

Major Components

- Requests and commands are sent from the graphic tablet to the graphic processor, and provide for visual and audible alerts

  - » Graphic display monitors

    (1) The two 19-inch color graphic display monitors provide extremely high resolution (1,280 X 1,024 pixels) which allows you to view base and derived products

    (2) These monitors are capable of extremely high resolution

    (3) They can be adjusted for viewing comfort by sliding them forward or backward on the table or by tilting them for the best viewing angle

Major Components

» Applications terminal

(1) The applications terminal provides for the control of the application software via computer menus

(2) The two major functions are to give commands to the PUP through the use of the alphanumeric keyboard and, to view the alphanumeric displays on the cathode-ray tube (CRT)

(3) The applications terminal allows the input of some commands that would normally be done by the graphic tablet and, therefore, serves as a backup to the tablet

(4) Data such as status messages and alert information is displayed on the applications terminal

Major Components

» Graphic tablet and puck

(1) The graphic tablet is your primary interface with the PUP

(2) Although certain functions can only be done from the applications terminal, you will perform most functions from this point

(3) Three basic modes of operation

a. Normal
b. Edit
c. Product parameter select

Major Components

(4) With the exception of editing background maps (which locks out most other functions), these modes are screen independent, ie, separate for each screen

(5) This means you can edit an alert area on the left screen while the right screen continues with normal operations

Major Components

» System console

(1) The PUP system console is either located on the same keyboard with the applications terminal or may be a separate alphanumeric terminal

(2) The system console provides access to the PUP's display processor and operating software (OS/32 and the CDS)

(3) You need to be familiar with a number of computer commands in order to bring the PUP to an orderly shutdown and to properly restart the PUP as well as copying system/application files and loading necessary tasks

Major Components

(4) Maintenance personnel also use it to run diagnostics of the system hardware

Major Components

» Hard copy device

(1) The WSR-88D comes equipped with a Tektronix color printer, which makes hard copies of the alphanumeric screen or either of the graphic monitors

(2) Print image resolution is 300 dots per square inch and the image processing time varies between 0-63 seconds

(3) To make a product copy, the operator simply places the puck over the HARD COPY selection box on the graphic tablet and pushes the left or right puck button, depending on which screen is to be printed

Major Components

(4) The product on the screen is then sent to the print queue for printing

(5) To print from the alphanumeric screen, a function key is provided on the keyboard

(6) Prints can be made on either paper or transparencies

(7) The transparencies are of very high quality and make excellent briefing aids

Communications

- **Wideband link**
  - **The wideband link is used to handle the flow of data between the RDA and the RPG**
  - **This link has a maximum data rate of 154 million bytes of data per second**

Communications

- **There are three options available for the wideband link depending on the distance between the RDA and RPG**
  - Hardwire is used when the RDA and the RPG are between 0 and 400 feet apart All DOD RDA/RPG sites will be configured by this method
  - Fiber optics
    - Used when separation is between 400 feet and 11 miles
    - A repeater may be used if the distance exceeds 11 miles

Communications

- Microwave line of sight (MLOS)
  - Consists of a transmitter and receiver that are shielded against electromagnetic interference
  - A dish antenna is used for MLOS transmission and reception Range for this type of medium, without a repeater, is between 3280 feet and 25 miles

Communications

- **Narrowband communications**
  - **Narrowband includes all other communication between the WSR-88D components**
  - **It includes modem interfaces to and from the RPG and associated PUPs, remote or local UCP, and any other external users of WSR-88D data**

Communications

- **Ports for narrowband links are designated as either dedicated, which is a full time connection (associated), or dial-up, which refers to dial-in, part time connections (non-associated)**

- **Product dissemination, commands, control and data requests between the RPG and the PUP are transferred at a rate of 144 Kbps**

- **UCP equipment is also connected to the host RPG by a 144 Kbps communications circuit**

Communications

- **Great feature of the communications hardware is the automatic re-initialization system**
- **If the communication cards become inactive they automatically re-initialize to avoid losing products at the PUP**
- **Resulting in a system status message on the PUP graphics screen, “Line XX Initializing”**

Data flow

- **RDA data flow**
  - **The RDA has produced the critical base data used by the RPG to build the meteorological products you need**
  - **However, this data may still be contaminated with things such as ground clutter, unwanted electromagnetic noise, and range-folded returns**

Data flow

- **The RDA has the job of processing and cleaning up this data before it goes to the RPG**
  - Analog to Digital Data Conversion
    - Before the base data are ready for clutter filtering, range unfolding, signal-to-noise thresholding, etc, it must first be converted from analog data to digitized data
    - This is the very first task accomplished on base data at the signal processor

Data flow

- Clutter filtering
  - The WSR-88D attempts to filter out most ground clutter long before you ever see the finished product on the screen
  - Clutter filtering is done by taking advantage of three very distinct properties common to most clutter
    - » First, ground clutter is usually stationary, or has near zero Doppler velocity
    - » Second, it has a small dispersion or spectrum width
    - » Thirdly, medium to high reflectivity values are associated with ground clutter

Data flow

- Spectrum width data is used in clutter filtering to distinguish between useful meteorological returns and non-meteorological returns

- The WSR-88D combines these features; near zero Doppler velocity and small spectral dispersion, to distinguish between meteorological targets and unwanted clutter

Data flow

- The UCP operator can select the degree of clutter filtering depending on the situation
  - » On mornings with a strong radiation inversion maximum filtering may be selected (superrefraction)
  - » Without an inversion, UCP operator might select reduced clutter filtering to none at all

Data flow

- The WSR-88D's signal processor utilizes a clutter map to filter out unwanted ground clutter
  - » This map is called the bypass map and is generated automatically by the WSR-88D
  - » The bypass map may need to be regenerated periodically to accommodate seasonal changes or clutter caused by new construction

Data flow

- Clutter suppression regions
  - » Another option exists where the operator can manually edit the clutter map for use under extremely abnormal atmospheric conditions
  - » The clutter suppression edit feature resides at the UCP
  - » With this feature the UCP operator tells the WSR-88D to filter specific azimuth/range locations
  - » This allows maximum flexibility by allowing the operator to select aerial coverage, the amount of Doppler/reflectivity suppression and a height where clutter suppression is desired

Data flow

- Data thresholding (Signal-to-Noise Ratio)
  - Data thresholding consists of suppressing those data points whose signal-to-noise ratios (usually about 3 dBZ) fall below a user-specified value
  - This process of signal to noise reduction (SNR) allows the RDA to ignore data, usually caused by system noise

Data flow

- Range unfolding
  - Range-folded (second-trip) echoes can have extremely adverse affects on our meteorological products
  - The RDA employs a process that can eliminate most range-folding problems
  - This process involves comparing all returns encountered at high PRFs to those received at a low PRF to determine which echoes are range folded
  - Range folding is likely to occur at high PRFs, but is rare at low PRFs
  - The RDA uses the target ranges determined from the low PRF to properly place the velocity and spectrum width data gathered at high PRFs

Data flow

- **RPG Data Processing**
  - **Velocity Dealiasing**
    - Velocity aliasing occurs when a velocity is detected which exceeds the Nyquist interval
    - When aliasing occurs, algorithm processing is impaired
    - The RPG executes an algorithm to dealias velocity data, before any meteorological algorithms use it

Data flow

- **Meteorological Algorithms**
  - Storm Analysis contains six algorithms that must be run in the following order, since each is dependent on the previous algorithm's output:
    - Storm Cell Segment
    - Storm Cell Centroid
    - Storm Cell Tracking
    - Storm Position Forecast
    - Hail Detection Algorithm
    - Storm Structure

Data flow

- Precipitation processing contains four algorithms that are executed in the following order:
  - Precipitation preprocessing
  - Precipitation rate
  - Precipitation accumulation
  - Precipitation adjustment
- Other Algorithms
  - Vertically Integrated Liquid
  - Severe Weather Probability

Data flow

- Clear-Air Analysis contains the following two algorithms:
  - Velocity Azimuth Display (VAD)
  - Velocity Volume Processing (VVP)

Data flow

- Kinematic Analysis contains the following five algorithms:
  - Shear
  - Transverse wind
  - Turbulence
  - Mesocyclone (MESO)
  - Tornado Detection Algorithm (TDA)

Data flow

- **System Algorithms**
  - Auto PRF Analysis: The auto PRF analysis contains the tasks that perform the analysis of storm data to select the best PRF to use in a given meteorological situation

Data flow

- Alert Processing
  - The RPG alerts all associated PUPs when weather meets or exceeds a predetermined user-specified threshold
  - Immediately upon detection of alert criteria three things happen
    - » First, the RPG initiates a User Alert Message (UAM) and transmits it to the PUP
    - » Second, the reception of the UAM causes an ear piercing alarm to be sounded at the PUP

Data flow

» Third, an alert-paired product is generated by the RPG and transmitted to the PUP

(1) The alert paired product that is received was predetermined by the URC

(2) The alert product generation tasks and alert message/paired products transmission are given the highest priority

Data flow

- **Loadshedding and product priority**
  - Any computer is at a danger of crashing due to limitations imposed on the system by a fixed amount of memory space and hard disk space
  - Without load control capability, if this space is totally used up the RPG will most likely crash
  - Loadshedding is a feature placed into the RPG as a "safety valve" if and when the RPG cannot satisfy customer requests
  - CPU loadshedding at the RPG occurs to ensure continued unit operations during periods when the RPG cannot satisfy all of the requirements placed on it

Data flow

- The CPU determines if loadshedding is required by forecasting the processing load for the next volume scan
- It bases this forecast on the processing load experienced during the previous volume scan
- It then modifies this estimate based on the number and type of products the RPG is currently producing and any additional products needed to satisfy customer requirements
- If the RPG determines it cannot satisfy all of these requirements, it begins to shed tasks based on the master task list prioritization

Data flow

- Effect of one-time product requests on loadshedding
  - A one-time product request is a product request from an associated user, for a product not on their Routine Products Set
  - A one-time product request causes the RPG to recalculate its processing load and reexamine its task priorities
  - This request may be honored based on its new priority, but may force the shedding of another task
  - Product generation for a one-time request has the second highest priority in the RPG
  - The only task with a higher priority is one that is generated as a result of an automated alert
  - One-time product requests from non-associated users do not receive a high priority, and will not force the RPG to loadshed

Data flow

- **PUP Data Processing**
  - The PUP via the narrowband communications link receives data from the RPG
  - Some data may be sent to the PUP automatically, some must be requested by the PUP, while other data may be assigned to accompany certain products

Data flow

- There are essentially three ways to receive data at the PUP: Routine Product Set (RPS), One-time product requests, and Alert Paired Products
  - Routine Product Set (RPS)
    - » A RPS is a list of product types and other associated parameters such as elevation slice, resolution, data levels, etc, which tells the associated RPG what products to send routinely and repeatedly over the dedicated communication line
    - » Up to ten different lists can be defined for specific weather situations, with up to 31 products defined in each list

Data flow

- One-time product requests
  - » A one-time product request is a request for a product not on the current RPS list
  - » Some products do not lend themselves for inclusion on the RPS list For example, a cross-section product requires the user to define the azimuth for which the cross-section is built

Data flow

- Alerts
  - » Whenever an alert is received at the PUP, an alert paired product will accompany the user alert message
  - » The pairing of products with alerts is decided by the URC

Data flow

- **Volumetric scanning**
  - **A scan strategy is a predetermined sequence of elevation slices and PRFs the antenna accomplishes during the completion of a volume scan**
  - **The WSR-88D is capable of eight different scan strategies (volume coverage patterns) of which four have been defined**
  - **The terms scan strategy and volume coverage pattern is typically used interchangeably, however, there is a conceptual difference**

Data flow

- **You can think of a volume coverage pattern as that area of the atmosphere that gets sampled**

- **The scan strategy on the other hand, is the actual mechanical and electrical processes employed by the radar**

Data flow

- **The Volume Coverage Patterns (VCP) are housed in two different weather modes: Precipitation mode (mode "A"), and Clear air mode (mode "B")**
  - Precipitation mode, or mode "A"
    - This is the system default mode
    - If a system reboot is performed, the weather mode will automatically become mode "A"
    - Otherwise switching of the weather mode is controlled by the UCP

Data flow

- A switch in weather modes will cause the default RPS list to be active
  - » A letter designator is used to identify RPS lists; there are 10 lists with ID letters “A” through “J”
  - » When the weather mode is changed to Mode “A” then RPS list “A” is invoked by the radar

Data flow

- In the precipitation mode there are currently two different volume coverage patterns available:

  » VCP 11: 14 elevations between 5° and 195° in 5 minutes

  a. VCP 11 provides a better coverage pattern (less gaps between higher elevation slices), however it greatly increases the processing workload of the RPG

  b. VCP 11 is best for severe weather close to the RDA, because it slices a storm more times providing detailed storm data

  c. VCP 11 limitation: The increased number of elevation angles intensifies the likelihood of loadshedding

Data flow

» VCP 21: 9 elevations between 5° and 195° in 6 minutes

a. VCP 21 is usually adequate for most non-severe precipitation events

b. VCP 21 is also best for severe weather away from the RDA, because the five lowest elevation slices for far range targets are the same as VCP 11 and "dwell time" is greater

c. Dwell time is defined as the amount of time the radar "looks" at a particular target thus more data is received

Data flow

d. Proper sequence of scan strategies begins with VCP 21

(1) When precipitation is first detected, weather mode “A” VCP 21 should be employed

(2) If the situation later dictates (ie, thunderstorms move in closer) then VCP 11 should be activated

(3) The strategy minimizes the effects of loadshedding, allowing for maximum product availability

(4) VCP 21 limitation: Increased number of data gaps doesn’t permit complete sampling of the atmosphere

Data flow

- Clear-Air Mode, or mode “B”
  - » In the clear-air mode, there are two available Volume Coverage Patterns, VCP 31 and VCP 32
  - » Both clear air mode VCPs complete 5 elevation slices in 10 minutes
  - » This is a slower scan than in the precipitation mode

Data flow

» The antenna rotation rate must be slow enough to allow increased signal returns from the clear air to reach the antenna for detection

a. Volume Coverage Pattern 31

(1) VCP 31 uses a longer pulse and a lower PRF to allow more power per pulse resulting in increased sensitivity

(2) The lower PRF results in a lower nyquist velocity The nyquist velocity for VCP 31 is 22 knots

Data flow

(3) The longer pulse allows more power to transmitted per pulse, which increases sensitivity and allows the radar to pick up returns from extremely small scatterers

(4) The use of a lower PRF also increases the maximum unambiguous range of the radar

Data flow

b. Volume Coverage Patter 32

(1) VCP 32 has a shorter pulse and a higher PRF to increase the Nyquist co-interval, and therefore increase the velocity resolution of the sample

(2) The nyquist velocity is 64 knots for VCP 32

(3) However, this shorter pulse results in less sensitivity, because it contains much less energy than the long pulse resulting in a weaker signal return to the antenna

(4) The use of a higher PRF also shortens the maximum unambiguous range of the radar

Data flow

c. Whenever clear air mode is invoked, the RPS list will change to the default list for mode “B”, which is RPR list “B”

Archiving

- **Archiving is simply the process of permanently recording data**
- **This data can be in many forms as it passes from one component of the radar to the other**
- **Archiving can be done at three locations and are identified as archive levels I, II, III, and IV**

Archiving

- **Each level is designed to archive the data as it progresses through the different components of the system**
  - **Archive Level I**
    - The archive level I interface is located at the RDA
      - Medium is an 8mm tape
      - The analog output of the receiver, information regarding synchronization, calibration, date, time, antenna position, and status are available at this level
      - Archive Use: Archive level I is mostly used for maintenance activities such as testing the signal processors

Archiving

- **Archive Level II**
  - The archive level II interface is also located at the RDA
  - Medium is an 8mm tape
  - The digital base data output from the signal processor is archived The digital base data are the reflectivity, velocity, and spectrum width output from the RDA

Archiving

- Archive use:
  - This archive level may very well be the most important and useful because it allows total recreation of a weather scenario
  - This archive data can be sent to the RPG for processing into products as though it was actually live data
  - Any product that can be created when the radar is sampling live data can be made from the archive level II data
  - Most research and development activity is accomplished using this data

Archiving

- Unfortunately, archive level II recording devices are only provided for training center and research and development use

- However, the entire weather community benefits from projects developed by these agencies

Archiving

- **Archive Level III**
  - The archive level III interface is located in the RPG
  - WORM (write once, read many) optical disc

Archiving

- All products produced by the RPG can be saved
  - The major difference between archive levels II and III is that only products generated by the RPG may be saved
  - You cannot go back and create a product from archive III if it was not originally produced while the archiving was being performed
  - The UCP operator can program the RPG to record all products, or selected products by name, or can even designate which volume scans to record the products, ie, every second or third scan
  - It has a storage capacity of approximately three months of data or over 600 megabytes

Archiving

- Archive use: This data is mainly used for training, studies, and historical record

Archiving

- **Archive Level IV**
  - The archive level IV interface is located in the PUP processor cabinet
  - Medium is the WORM (write once, read many) optical disc
  - All products stored in the PUP database
    - This level is identical to archive level III
    - The only difference is simply the location at which the recording is accomplished
    - An archive level III disc can be played from a PUP, and vice versa
    - All PUPs are equipped with an archive level IV recording device so you will get plenty of chances to use it

Archiving

- Archive use: This recording capability is very useful for forecast studies, local reference files for training, and anytime-significant weather events occur and a permanent record is desired

- APPLICATION: Throughout the entire lesson
- EVALUATION: Administer A-501b now and the Written Test at the end of the unit.